# OBSERVATIONS CONCERNING THE LIFE CYCLE OF SPONGOMORPHA COALITA (RUPRECHT) COLLINS

G. J. Hollenberg

The work of Smith (1947) showed that in *Spongomorpha coalita* all plants are sexual, producing biflagellate gametes only. Smith concluded that this species of *Spongomorpha* does not exhibit an isomorphic alternation of generations. He observed that zygotes are negatively phototropic but did not follow their development.

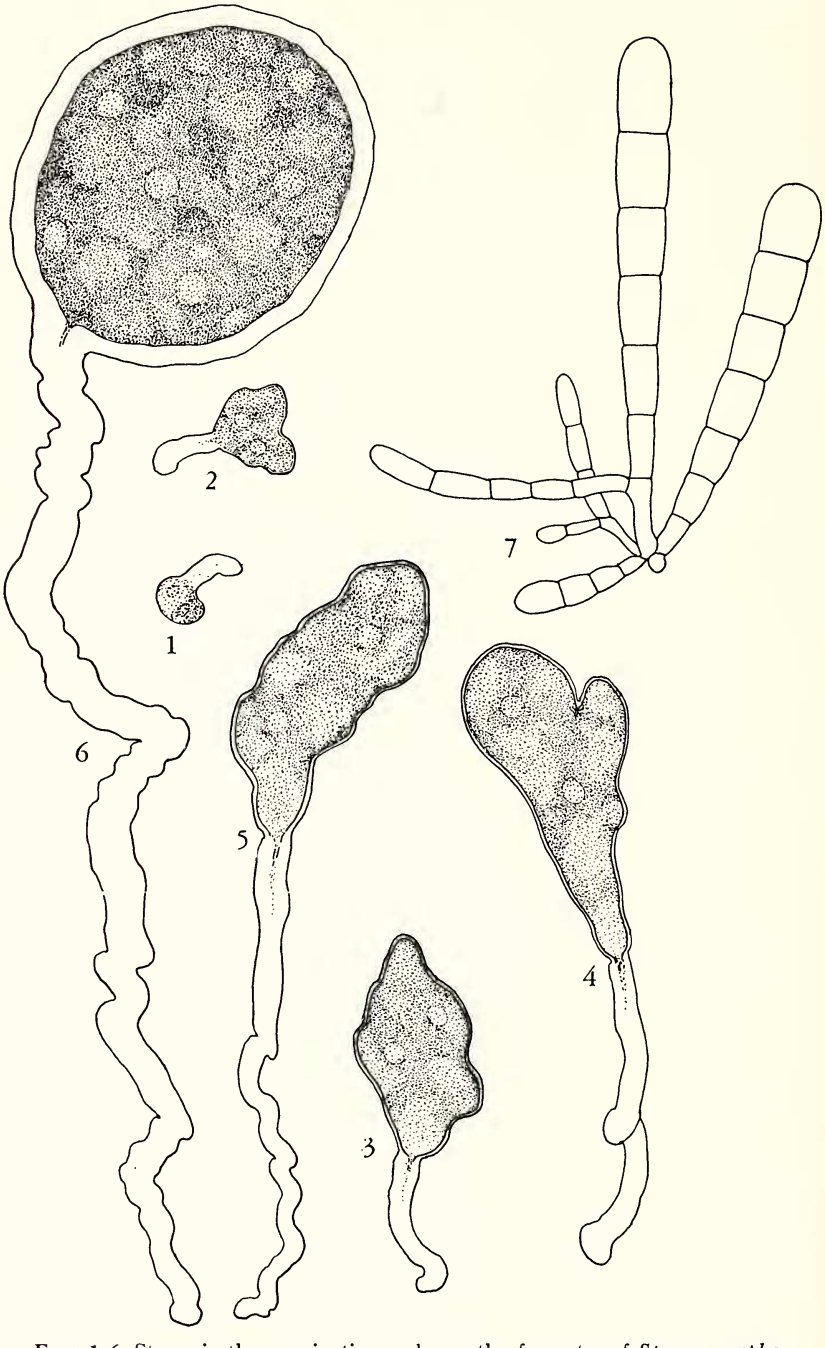
During the summers of 1953–1956 inclusive the writer made culture studies of this plant at the Hopkins Marine Station at Pacific Grove, California. The cultures were kept in a cool humid basement room with northern light at 16–20° C. Discharge of gametes was obtained in a manner similar to that described by Smith. Advantage was taken of the negative phototactic response of the fusing gametes, also described by Smith, in getting cultures of zygotes relatively free of diatoms. The culture solution was sea water which had been heated nearly to the boiling point and allowed to cool. Nutrients were added as described for previous cultures by the writer (Hollenberg, 1939).

The zygotes are very small, measuring mostly 3–4 μ in diameter. Smith states that the gametes lack a pyrenoid. The writer likewise observed no pyrenoid in the gametes, but very young germlings (figs. 1–3) showed two distinct pyrenoids. At this stage the chromatophore seemed to be of a reticulate nature. Perhaps more than one was present.

Within a few days it became evident that the original outgrowth of the zygote, which forms during germination, constituted a colorless rhizoidal outgrowth. Within two or three weeks it seemed apparent that this rhizoidal outgrowth represented some sort of attachment or penetration organ (figs. 3–6). Growth of the unicellular structure was very slow and no cross walls appeared, but as the rhizoidal process elongated the original cell became more or less spherical and gradually enlarged. When about 30 days old many of the germlings had become as much as 30 μ in diameter, with thick walls and dense chromatophore with a number of pyrenoids (fig. 6). The rhizoidal process was up to 100 μ long and mostly very contorted.

Although the pigmented cells increased slightly more in diameter, they seemed to become dormant and in most cases finally died or were overrun with diatoms. However, the culture started on July 19, 1955, remained alive until October 29, 1955, when it was discovered that several branching multicellular plants had developed from the unicellular germlings on the squares of cover glass in the culture dishes. The cells of these plants contained each a reticulate chloroplast and a number of pyrenoids. One of these plants had reached a length of 2 millimeters, but unfortunately the culture had become so overgrown with diatoms that the diminutive

Madroño, Vol. 14, No. 8, pp. 249–280. October 17, 1958.




FIGS. 1–6. Stages in the germination and growth of zygotes of *Spongomorpha coalita*, × 1600.
FIG. 7. Multicellular plantlet developing from a *Spongomorpha* zygote, × 35.

plants soon died. Since these multicellular plants developed directly from the bulbous part of the unicellular germlings on the pieces of coverglass, no free-swimming zoospores were involved in their development under the particular culture conditions.

In the cultures of the following summer no multicellular plants were obtained.

The slow growth and seeming dormancy of the zygotes and the development of the rhizoidal outgrowth, as well as the fact that the germlings continued to remain unicellular, suggested early in this study that they were probably some endophyte such as *Codiolum*. Several unsuccessful efforts were made to find *Codiolum* during the summer season in order to explore a possible relationship of this plant to *Codiolum*. Possibly *Codiolum* is seasonal in its appearance.

The failure to find zoospores arising from the unicellular germlings, and the failure of the multicellular plants arising in the cultures to develop to the stage in which the characteristic hooks arise on the branches, leaves some gaps in the suggested life cycle, but there seems to be little reason to doubt that the multicellular branched plants were young *Spongomorpha* plants. However, the culture studies on this plant have been discontinued because another investigator, Kung Chu Fan, is studying this problem. His more conclusive studies will be reported in the literature soon. Preliminary reports of Fan's work (1957) and that of the writer (Hollenberg, 1957) have been previously given.

It should also be noted that Jónsson (1957) has shown that a life cycle similar to the one suggested above for *Spongomorpha* occurs in the case of a closely related genus *Acrosiphonia*.

In summary, the above study shows that zygotes of *Spongomorpha coalita* developed slowly in the cultures into unicellular germlings with contorted rhizoidal outgrowths and that some of the germlings gave rise to branched multicellular plants believed to represent young *Spongomorpha* plants. The unicellular stage is believed to be an endophyte similar to or identical with *Codiolum*.

Department of Biology,
University of Redlands,
Redlands, California.

## Literature Cited

Fan, K. C. 1957. Observations on the life history of Codiolum petrocelidis. Phycological News Bull. 10:75.

Hollenberg, G. J. 1939. Culture studies of marine algae. I. Eisenia arborea. Am. Jour. Bot. 26:34–41.

———. 1957. Culture studies of Spongomorpha coalita. Phycological News Bull. 10:76.

Jónsson, M. S. 1957. Sur la reproduction et la sexualite de l'Acrosiphonia spinescens (Kütz.) Kjellm. Compt. Rend. Acad. Sc. Paris. 244:1251–1254.

Smith, G. M. 1947. On the structure and reproduction of Spongomorpha coalita (Rupr.) Collins. Jour. Indian Bot. Soc. 1946:201–208.